

the invention either alone or with adjunctive therapies will now be described, but it will be appreciated that the methods in accordance with the invention can be used in many additional applications.

a. General Applications

5 The embodiments of the electrical stimulation methods described above are expected to be particularly useful for rehabilitating a loss of mental functions, motor functions and/or sensory functions caused by damage to the brain. In a typical application, the brain has been damaged by a stroke or trauma (e.g., automobile accident). The extent of the particular brain damage can be assessed using functional
10 MRI or another appropriate imaging technique as explained above with respect to Figure 3. A stimulation site can then be identified by: (a) peripherally stimulating a body part that was affected by the brain damage to induce the intended neural activity and determining the location where a response neural activity occurs; (b) determining where the neural activity has changed as a patient gains more use of the affected body
15 part; and/or (c) estimating the location that the brain may recruit neurons to carry out the neural activity that was previously performed by the damaged portion of the brain. An electrical stimulation therapy can then be applied to the selected stimulation site by placing the first and second electrodes relative to the stimulation site to apply an electrical current in that portion of the brain. As explained in more detail below, it is
20 expected that applying an electrical current to the portion of the brain that has been recruited to perform the neural activity related to the affected body part will produce a lasting neurological effect for rehabilitating the affected body part.

Several specific applications are expected to have a stimulation site in the cortex because neural activity in this part of the brain effectuates motor functions
25 and/or sensory functions that are typically affected by a stroke or trauma. In these applications, the electrical stimulation can be applied directly to the pial surface of the brain or at least proximate to the pial surface (e.g., the dura mater, the fluid surrounding the cortex, or neurons within the cortex). Suitable devices for applying

the electrical stimulation to the cortex are described in detail with reference to Figures 6-40.

The electrical stimulation methods can also be used with adjunctive therapies to rehabilitate damaged portions of the brain. In one embodiment, the electrical stimulation methods can be combined with physical therapy and/or drug therapies to rehabilitate an affected neural function. For example, if a stroke patient has lost the use of a limb, the patient can be treated by applying the electrical therapy to a stimulation site where the intended neural activity is present while the affected limb is also subject to physical therapy. An alternative embodiment can involve applying the electrical therapy to the stimulation site and chemically treating the patient using amphetamines or other suitable drugs.

The embodiments of the electrical stimulation methods described above are also expected to be useful for treating brain diseases, such as Alzheimer's, Parkinson's, and other brain diseases. In this application, the stimulation site can be identified by monitoring the neural activity using functional MRI or other suitable imaging techniques over a period of time to determine where the brain is recruiting material to perform the neural activity that is being affected by the disease. It may also be possible to identify the stimulation site by having the patient try to perform an act that the particular disease has affected, and monitoring the brain to determine whether any response neural activity is present in the brain. After identifying where the brain is recruiting additional matter, the electrical stimulation can be applied to this portion of the brain. It is expected that electrically stimulating the regions of the brain that have been recruited to perform the neural activity which was affected by the disease will assist the brain in offsetting the damage caused by the disease.

The embodiments of the electrical stimulation methods described above are also expected to be useful for treating neurological disorders, such as depression, passive-aggressive behavior, weight control, and other disorders. In these applications, the electrical stimulation can be applied to a stimulation site in the cortex or another suitable part of the brain where neural activity related to the particular disorder is present. The embodiments of electrical stimulation methods for carrying out the